

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
 NUMBER: M4-1BG-CV010-02

SUBSYSTEM: ELECTRICAL POWER GENERATION - CRYO, GENERIC REVISION# 1 11/12/91 R

ITEM NAME: CHECK VALVE CRITICALITY OF THIS FAILURE MODE: 1R2

■ FAILURE MODE:
 FAILS CLOSED

MISSION PHASE:

- PL PRELAUNCH
- LO LIFT-OFF
- OO ON-ORBIT
- DO DE-ORBIT
- LS LANDING SAFING

- VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
- : 103 DISCOVERY
- : 104 ATLANTIS
- : 105 ENDEAVOUR

■ CAUSE:
 CONTAMINATION, CORROSION

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

- REDUNDANCY SCREEN A) PASS
- B) PASS
- C) PASS

PASS/FAIL RATIONALE:

- A)
- B)
- C)

- FAILURE EFFECTS -

■ (A) SUBSYSTEM:
 SUBSYSTEM DEGRADATION - LOSS OF CAPABILITY TO DISTRIBUTE CONSUMABLES FROM ONE O2 SUPPLY TANK.

■ (B) INTERFACING SUBSYSTEM(S):
 REDUCED QUANTITY OF O2 CONSUMABLES AVAILABLE FOR THE ECLSS AND FUEL

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CELL POWERPLANT OPERATION.

- (C) MISSION:
MINIMUM DURATION MISSION INVOKED.
- (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT AFTER FIRST FAILURE.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE IF THE ASSOCIATED TANK RELIEF VALVE FAILS TO CRACK (TANK RUPTURE). ALSO, FAILURE OF THE O2 TANK 1 OR 2 CHECK VALVE IN CONJUNCTION WITH THE MANIFOLD ISOLATION VALVE IMMEDIATELY DOWNSTREAM FAILING CLOSED, RESULTS IN INSUFFICIENT O2 FLOW TO THE LAUNCH/ENTRY SUIT (LES). LOSS OF THIS EMERGENCY SYSTEM MAY RESULT IN LOSS OF CREW/VEHICLE.

- DISPOSITION RATIONALE -

- (A) DESIGN:
VALVE PROTECTED AGAINST CONTAMINATION BY A 12 MICRON ABSOLUTE FILTER UPSTREAM OF VALVE AND A 45 MICRON ABSOLUTE FILTER SCREEN IN VALVE. VALVE IS CONSTRUCTED OF CORROSION RESISTANT MATERIALS (304L, 304 COND. B, RC 55 ELGILOY).
- (B) TEST:
QUALIFICATION TEST INCLUDED THERMAL/OPERATING LIFE CYCLE TESTING (300K CYCLES) WITH NO EVIDENCE OF CHATTER, EXCESSIVE WEAR, CONTAMINATION, OR OPERATIONAL DEGRADATION.

ACCEPTANCE TEST VERIFIES CRACKING PRESSURES ARE WITHIN LIMITS (3 +2/-0 PSI) TOLERANCE AND PRESSURE DROP DOES NOT EXCEED 7.5 PSI AT MAXIMUM SYSTEM FLOW RATES. VALVE VERIFIED CLEANED TO LEVEL 200A BY PARTICLE COUNT AND NON-VOLATILE RESIDUE (NVR). VALVE OPERATION IS FURTHER VERIFIED DURING PANEL MODULAR ASSEMBLY AND SUBSYSTEM CHECKOUT.

CMRSD: CHECK VALVE OPERATION VERIFIED EVERY FLIGHT.
- (C) INSPECTION:
RECEIVING INSPECTION
MATERIAL CERTIFICATIONS AND TEST REPORTS ARE REVIEWED TO VERIFY THAT MATERIAL COMPOSITION, DIMENSIONS, AND SURFACE CONDITIONS COMPLY WITH DESIGN REQUIREMENTS.

CONTAMINATION CONTROL
ACCOMPLISHMENT OF PREASSEMBLY CLEANING, VAPOR DEGREASING, AND ULTRASONIC CLEANING IS VERIFIED. PIECE PART CLEANLINESS IS CERTIFIED

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TO LEVEL 200A (MA0110-301) BY AN NVR AND PARTICLE COUNT (50 ML FLUSH THROUGH A MILLIPORE FILTER). COMPONENT ASSEMBLY, PACKAGING, AND SUBSEQUENT SUBASSEMBLY INSTALLATION ARE ACCOMPLISHED IN 100,000 CLASS CLEANROOM ENVIRONMENTS. COMPLETED ASSEMBLY IS VERIFIED TO LEVEL 200A.

CRITICAL PROCESSES

PARTS PASSIVATION, ELECTRON BEAM WELDING AND INDUCTION BRAZING PROCESSES ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

ELECTRON BEAM WELDS ARE INSPECTED FOR DEFECTS UNDER 10X VISUAL EXAMINATION DURING COMPONENT ASSEMBLY. INDUCTION BRAZING IS RADIOGRAPHICALLY INSPECTED DURING MODULAR ASSEMBLY.

■ (D) FAILURE HISTORY:

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

■ (E) OPERATIONAL USE:

CREW WILL DEACTIVATE ASSOCIATED TANK HEATERS IN RESPONSE TO HIGH PRESSURE FALLT ANNUNCIATION. CREW ENABLES REDUNDANT TANK HEATERS TO SUPPLY REACTANTS TO THE FUEL CELLS.

- APPROVALS -

RELIABILITY ENGINEERING:	M. D. WEST	:	<u>M. D. West</u>
DESIGN ENGINEERING	: M. M. SCHEIERN	:	<u>M. M. Scheiern</u>
QUALITY MANAGER	: O. J. BUTTNER	:	<u>O. J. Buttner</u>
NASA RELIABILITY	:	:	<u>[Signature]</u>
NASA SUBSYSTEM MANAGER	:	:	<u>[Signature]</u>
NASA QUALITY ASSURANCE	:	:	<u>[Signature]</u>